

Appl. No. : Unknown
Filed : Herewith

IN THE CLAIMS:

Please cancel Claims 1-16.

Please add the following new claims:

17. (Added) A method of depositing a thin film on a substrate, in which method a substrate placed in a reaction space including a reaction chamber is subjected to alternately repeated surface reactions of at least two vapor-phase reactants for the purpose of forming a thin film, the method comprising

feeding the reactants in the form of vapor-phase pulses repeatedly and alternately, each reactant fed from a separate source, into the reaction space, and

bringing the vapor-phase reactants to react with a surface of the substrate for the purpose of forming a solid-state thin film compound on the substrate,

wherein

a gas volume of the reaction space is evacuated essentially totally in an interval between each two successive vapor-phase reactant pulses.

18. (Added) The method of Claim 17, wherein the gas volume of the reaction space is evacuated at least twice in the interval between each two successive vapor-phase reactant pulses.

19. (Added) The method of Claim 17, wherein the gas volume of the reaction space is evacuated 3-10 times in the interval between each two successive vapor-phase reactant pulses.

20. (Added) The method of Claim 17, wherein the gas volume of the reaction space is evacuated so that residual components of an immediately preceding vapor-phase reactant pulse remaining in the reaction chamber are reduced to a level of less than 1 % during the interval prior to the inflow of a subsequent vapor-phase pulse.

21. (Added) The method of Claim 17, wherein the gas volume of the reaction space is evacuated so that residual components of an immediately preceding vapor-phase reactant pulse remaining in the reaction chamber are reduced to a level of less than 0.1 % during the interval prior to the inflow of a subsequent vapor-phase pulse.

22. (Added) The method of Claim 17, wherein an inactive gas is fed into the reaction space simultaneously as the reaction space is being evacuated from residues of the latest vapor-phase reactant pulse.

23. (Added) The method of Claim 22, wherein the reaction space is connected to a pump having a volumetric capacity which during the interval between each two successive vapor-phase reactant pulses is appreciably greater than the gas volume of the reaction space.

24. (Added) The method Claim 17, wherein each reactant is fed into the reaction chamber via a separate inflow path in order to minimize the gas volume to be evacuated from the reaction space.

25. (Added) The method of Claim 17, wherein each vapor-phase reactant pulse is mixed with the inactive gas flow prior to its entry into the reaction space.

26. (Added) The method of Claim 17, wherein the reaction space is defined by the reaction chamber configured to house the substrate, further comprising providing gas flow channels in communication with the reaction chamber, the gas flow channels being suited for the inflow of the vapor-phase reactant pulses into the reaction chamber and, correspondingly, for the outflow of excess components of the reactant pulses from the reaction chamber, characterized in that at least a portion of the gas flow channels are provided with a narrow, oblong cross section in order to minimize the volume of the reaction space.

27. (Added) The method of Claim 17, wherein the reaction space is defined by the reaction chamber configured to house the substrate, further comprising providing gas flow channels in communication with the reaction chamber, the gas flow channels being suited for the inflow of the vapor-phase reactant pulses into the reaction chamber and, correspondingly, for the outflow of excess components of the reactant pulses and gaseous reactant byproducts from the reaction chamber, wherein the reaction chamber is provided with a narrow, oblong cross section in order to minimize the volume of the reaction space.

28. (Added) The method of Claim 27, characterized in that the vapor-phase reactant pulses are fed via gas flow channels having a narrow, oblong cross section in order to form at least essentially planar pulses of vapor-phase reactant and to improve intermixing of the vapor-phase reactant flow with a carrier gas flow.

29. (Added) The method of Claim 27, characterized in that the vapor-phase pulses of each reactant group are fed via their individual inflow channels directly into the reaction chamber, wherein the vapor-phase pulse is allowed to intermix with a carrier gas flow prior to bringing the reactant into contact with the substrate.

30. (Added) The apparatus of Claim 27, wherein the gas flow channels each include an infeed opening to the reaction chamber having a width-to-height ratio between about 5:1 and 50:1.

31. (Added) The apparatus of Claim 30, wherein the infeed opening width-to-height ratio is between about 5:1 and 30:1.

32. (Added) The method of Claim 17, wherein the vapor-phase reactant pulses are fed in an at least essentially laminar flow into the reaction chamber.

33. (Added) The method of Claim 17, wherein the interval is on the order of 1 second.

34. (Added) The method of Claim 33, wherein the gas volume of the reaction space is evacuated at least twice in the interval between each two successive vapor-phase reactant pulses.

35. (Added) The method of Claim 33, wherein the gas volume of the reaction space is evacuated 3-10 times in the interval between each two successive vapor-phase reactant pulses.

36. (Added) The method of Claim 17, wherein feeding the reactants comprises defining a gas flow front entering the reaction chamber with a width between about 10 cm and 30 cm.

37. (Added) The method of Claim 36, wherein the gas flow front has a height between about 1 cm and 3 cm.

38. (Added) The method of Claim 17, wherein the reaction space defines a width-to-height ratio between about 1:1 and 100:1

39. (Added) The method of Claim 38, wherein the width-to-height ratio is between about 5:1 and 50:1

40. (Added) The method of Claim 38, wherein the width-to-height ratio is between about 5:1 and 30:1.

41. (Added) A method of depositing thin films by atomic layer deposition, wherein at least first and second vapor-phase reactants are alternately fed to a reaction chamber from separate inflow channels, the method comprising a plurality of cycles in which each cycle includes:

in a first pulse, flowing the first vapor-phase reactant through a first inflow channel opening directly into the reaction chamber, the reaction chamber housing a substrate upon which a thin film is to be deposited;

in the first pulse, flowing only an inactive gas through a second inflow channel while flowing the first vapor-phase reactant through the first inflow channel, the second inflow channel opening directly into the reaction chamber;

in a second pulse, flowing the second vapor-phase reactant through the second inflow channel;

in the second pulse, flowing only an inactive gas through the first inflow channel while the second vapor-phase reactant flows through the second inflow channel; and

evacuating essentially totally a gas volume of a reaction space in an interval between each two successive pulses of the first and second vapor-phase reactants, the reaction space defined by the reaction chamber, the first inflow channel and the second inflow channel.

42. (Added) The method of Claim 41, further comprising allowing the first vapor-phase reactant from the first inflow channel to mix with the inactive gas from the second inflow channel within the reaction chamber upstream of the substrate during the first pulse, and allowing the second vapor-phase reactant from the second inflow channel to mix with the inactive gas from the first inflow channel within the reaction chamber upstream of the substrate during the second pulse.

43. (Added) The method of Claim 41, wherein the gas volume of the reaction space is evacuated at least twice in the interval between each two successive pulses of the first and second vapor-phase reactants.